



SIMPLOT PHOSPHATES LLC  
(435) 789-7795

9401 NORTH HWY. 191

VERNAL, UTAH 84078

October 8, 2015

April  
Wayne  
Lynn  
6920

Mr. Paul B. Baker  
Utah Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
Salt Lake City, UT 84114-5801

RECEIVED

OCT 13 2015

DIV. OF OIL, GAS & MINING

**RE: RESPONSE TO DIVISION REVIEW OF TAILINGS STORAGE FACILITY AMENDMENT,  
SIMPLOT PHOSPHATES LLC, VERNAL PHOSPHATE MINE, M/047/0007, Uintah County,  
UTAH**

Dear Mr. Baker:

Simplot Phosphate LLC (Simplot) has prepared this cover letter and attached responses to the Utah Division of Oil, Gas and Mining's (DOGM) review comments to the updated mining and reclamation plan application for the Vernal Phosphate Mine's tailings storage facility (TSF). The updated mining and reclamation plan was submitted on June 1, 2015 in response to the DOGM's directive, dated March 30, 2015, requesting that the Operational and Reclamation Plan for the TSF be updated. This submittal has addressed the corrections and deficiencies identified by DOGM from the Division's initial review to facilitate approving this amendment. The attachments include the following:

- Form MR-REV-att, Application for Mineral Mine Plan Revision or Amendment, Detailed Schedule of Changes to the Mining and Reclamation Plan; and,
- Revised pages in redline/strikeout.

As requested, Simplot has addressed those items identified from DOGM's technical review by preparing replacement pages using redline and strikeout text. It is understood that after the amendment is determined technically complete, the Division will request two clean copies of the complete and corrected amendment. Upon final approval, both copies will be stamped approved, and one will be returned Simplot's your records.

If you have any questions, please feel free to contact me at (435) 781-3348.

Sincerely,

John Spencer  
Environmental/Senior Mining Engineer  
Simplot Phosphates LLC



July 1, 2015

John Spencer  
Simplot Phosphates, LLC  
9401 North Highway 191  
Vernal, Utah 84078-7802

Subject: Initial Review of Tailings Storage Facility Amendment, Simplot Phosphates LLC, Vernal Phosphate Mine, M/047/0007, Uintah County, Utah

Dear Mr. Spencer:

Thank you for submitting an updated mining and reclamation plan for the tailings storage facility. The Division of Oil, Gas and Mining has reviewed the modifications which were received June 1, 2015. The submittal has a few corrections and deficiencies that need to be made prior to approving this amendment.

The comments are listed under the applicable Minerals Rule heading; please format your response in a similar fashion. Please address only those items requested in the attached technical review by sending replacement pages using **redline and strikeout** text. After the amendment is determined technically complete, the Division will ask that you submit two clean copies of the complete and corrected amendment. Upon final approval, both copies will be stamped approved, and one will be returned for your records.

The Division will suspend further review pending receipt of your response. Please contact April Abate at 801-538-5214 or me at 801-538-5261 if you have questions about the comments or if you would like to arrange a meeting to discuss them. Thank you for your cooperation in completing this permitting action.

Sincerely,

Paul B. Baker  
Minerals Program Manager

PBB: aa: eb  
Attachment: Review  
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**INITIAL REVIEW OF NOTICE OF INTENTION  
TO COMMENCE LARGE MINING OPERATIONS**

Simplot Phosphates, LLC  
**Vernal Phosphate Mine**  
M/047/0007  
July 1, 2015

**General Comments:**

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
1	General	The Division may have additional comments based on the responses to the issues raised in this review.	aa	Comment acknowledged.
2	Page 3a	The life of mine estimate shows the year 2043, but it is written as 2,043. Please correct this typo.	aa	The typo is in Section 3A, Page 4a. The typo has been corrected.
3	Section 3B	The Raise 2 embankment elevation is documented as 5,985 amsl. The text states that the next level—the Raise 3 embankment—will be at an elevation of 5,600 feet, lower than the Raise 2 level. Cross section maps show the Raise 3 level at an elevation of 6,000 amsl. Please correct this discrepancy in the text.	aa	The elevation has been corrected to 6,000 ft. amsl.
4	Section 3B Page 4a	The text refers to an alternative site proposed for tailings know as the “B” site. The “B” site could not be located on any page in Appendix L or in the main NOI document.	aa	The reference to the “B” site has been removed from the text.
5	Section 3B page 4a	Please remove the last paragraph stating that the TSF expansion will be submitted as a significant revision. The TSF has already been approved and this submittal represents an amendment update.	aa	The paragraph has been deleted.

**R647-4-106 - Operation Plan**

**106.2 - Type of operations - mining method, onsite processing, deleterious or acid-forming materials**

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
6	NOI 106.2	Section 106.2 in the NOI will need to be edited to include a reference to Appendix L which contains the TSF detail information. Currently, the NOI summarizes the TSF facility, but there is no reference pointing to the information in Appendix L.	aa	The NOI has been edited to include the reference to Appendix L.

**106.7 - Existing vegetation - species and amount**



Initial Review  
Page 3 of 3  
M/047/0007  
July 1, 2015

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
7	Sec. 6H	The operator provided a vegetation test plot map showing the types of species that are being tested for reclamation success but indicated that no data was available other than visual observations. The Division needs additional data to evaluate which species are successful and which are not. Please provide a vegetation monitoring report by October 31, 2015.	aa/lk	Simplot will provide a vegetation monitoring report by October 31, 2015, as requested.

#### **R647-4-110 - Reclamation Plan**

##### **110.2 – Reclamation of roads, highwalls, slopes, impoundments, drainages, pits, piles, shafts, adits, etc**

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
8	NOI 110.2	Section 110.2 of the NOI under "Impoundments" contains a reference that reclamation of the TSF will be done in accordance with the March 2000 plan. This reference needs to be updated and refer to the information contained in Appendix L.	aa	The reference has been updated in the NOI.

#### **R647-4-112 - Variance (List all variances requested and make a finding if approving.)**

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
9	Sec. 7C	(No response required.) A variance was granted in 2000 when the initial tailings expansion amendment was submitted. The variance requested that 16,500 cubic yards of salvageable topsoil that was identified in the permit area not be used in reclamation of the tailings dumps. The topsoil from these various locations is found in areas which would require the creation of access roads that would cross BLM lands, which could trigger an Environmental Assessment evaluation. Furthermore, the total amount of topsoil that would be available for redistribution on the tailings would only amount to 0.25 inch depth. Although there was no request associated with this permitting action for the Division to review the variance, the Division reevaluated the variance and found that the previous decision on granting the variance should continue to be upheld.	aa/lk	Simplot acknowledges this comment.

#### **R647-4-113 – Surety**

Comment #	Sheet/Page/Map/Table #	Comments	Initials	Review Action
10	46a	The information submitted in the bonding calculation worksheet will need to be merged with the master bonding calculations located in Appendix M.	aa	The information is included in the master bonding calculation
11	46a	Please include worksheets to show the productivity for reclaiming the tailing ponds. The worksheets are on the Division's webpage and are similar to those in the approved NOI. Footnote #3 says to see the productivity spreadsheets, but they were not included for this operation.	whw	The productivity worksheets have been added to the amendment.
12	46a	Please include the costs on the summary sheet.	whw	Labor and equipment costs have been added to the summary sheet.

Commented [BM1]: John, please confirm.



# Application for Mineral Mine Plan Revision or Amendment

**Operator:** Simplot Phosphates, LLC

**Mine Name:** Vernal Phosphate Operations

**File Number:** M/047/0007

Provide a detailed listing of all changes to the mining and reclamation plan that will be required as a result of this change. Individually list all maps and drawings that are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise or amend the existing Mining and Reclamation Plan. **Include page, section and drawing numbers as part of the description.**

## DETAILED SCHEDULE OF CHANGES TO THE MINING AND RECLAMATION PLAN

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Updated NOI East Side Expansion Section R647-4-106.2. Replace page 6 with Replacement page 6
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Updated NOI East Side Expansion Section R647-4-110.2. Replace page 27 with Replacement page 27
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Updated NOI East Side Expansion Section R647-4-110.2. Replace page 28 with Replacement page 28
<input type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	
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**I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments and obligations, herein.**

*Mark A. Krack*

Print Name

*Mark A. Krack*

Sign Name, Position

*10/8/15*

Date

**Return to:** State of Utah  
 Department of Natural Resources  
 Division of Oil, Gas and Mining  
 1594 West North Temple, Suite 1210  
 Box 145801  
 Salt Lake City, Utah 84114-5801  
 Phone: (801) 538-5291  
 Fax: (801) 359-3940

**FOR DOGM USE ONLY:**  
 File #: M/047/0007

**Approved:** \_\_\_\_\_  
**Bond Adjustment:** from \$ \_\_\_\_\_  
 to \$ \_\_\_\_\_





ore is crushed to minus 8 inches and then conveyed to the semi-autogenous grinding (SAG) mill. The ore is typically stockpiled (often 10 to 30 days of ore) outside the SAG mill (Figures 5 and 5b2). Stockpiled ore is then fed to the mill by apron feeders. The SAG mill grinds the ore and creates an ore slurry. The ground ore slurry is then pumped through a pipeline to the concentrator facility (mill) (Figures 5 and 5a).

At the concentrator facility mill, the ore slurry is ground further in a ball mill in closed circuit with hydrocyclone classifiers. Clay fines from the classifiers are considered tailings and are pumped to the TSF. The coarser material from the classifiers is conditioned in mixer tanks with flotation reagents, including diesel oil, fatty acid, and polymers, and then processed through a bank of flotation cells. In the flotation cells, the phosphate mineral grains are separated from the barren sand, which is pumped to the TSF tailings dam cyclones. The phosphate mineral grains are removed from the top of the flotation cells and pumped to a thickener where the density of the slurry is adjusted before being pumped through a 96-mile-long buried slurry pipeline to Rock Springs, Wyoming. Clarified water from the TSF is reclaimed in barge-mounted pumps and returned to the grinding facility for reuse.

The TSF includes a dam and the impoundment of water and tailings (see Appendix L). Two types of tailings slurry produced in the mill are transported separately to the TSF for disposal. Fine tailings slimes are discharged by gravity flow to the northeast area of the tailings impoundment. Coarser tailings from the flotation cells are typically pumped to the crest of the tailings dam, and cycloned there, then discharged along the upstream face of the dam. The sand fraction of the cycloned tailings solids form a 150- to 200-foot-wide sand beach along the upstream face of the dam, and the clay and silt slimes fraction flow to the western portions of the impoundment. Figure 3c illustrates the TSF area and Appendix L provides details on tailings design, management, and reclamation.

Clarified tailings water is reclaimed from the west end of the impoundment at barge-mounted reclaim pumps to be recycled to the mill process. The supernatant pond covers much of the tailings surface. It is shallow over most of the tailings and attains its maximum depth in the western area of the impoundment near the reclaim barge. Water reclaimed from the TSF is reused in the beneficiation process. It is also used for transporting the phosphate concentrate to Rock Springs in the buried slurry pipeline.

The existing tailings dam is constructed of compacted siltstone obtained from local borrow areas in the Moenkopi Formation. Seepage of tailings water through the dam is controlled with chimney drains, blanket drains, and collector drains that intercept seepage and direct it to the downstream toe of the dam. The downstream outlets of the three main collector drains are fitted with measuring devices to allow the seepage flow rates to be individually monitored. These outlets are located at the downstream toe of the dam in the bottoms of three main drainages crossed by the dam.

The TSF is operated under Utah permit UGW470001. Operation and maintenance of the facility follows Simplot's *Tailings Storage Facility Operating, Maintenance, and Monitoring Manual* (Golder 2011).

In 2010, Simplot changed part of its mining operations procedures. In order to optimize the drilling and blasting, and overall mining operations, it went from a two-phase, two-bench stripping operation to a one-step, one-bench stripping operation. The old procedures entailed drilling and blasting the top of overburden (typically 40 to 65 feet below ground surface [bgs]), then removing it with a loader/truck fleet. The second step was to repeat the drilling and blasting on the bench created by



initiation to reclamation. The filled area is then re-contoured, top soil redistributed to the surface, ground roughened to prepare for seed, and the area seeded. Due to the overall uniformity of the depth and thickness of the ore, depressions and ridges generally reflect the re-graded overburden resulting in an approximate pre-mining contour. In addition, drainage patterns are reconstructed such that upslope and downslope drainages are tied together to the greatest extent as practicable.

As illustrated in **Figures 12a and 14**, the last pit in a panel, as well as sometimes the adjacent ground on the side of a pit, results in a highwall. It is Simplot's practice is to leave the upper portion of highwalls exposed after mining. Whereas the lower portion of the highwall is filled with overburden to ensure stability. The overall slope of the highwall (crest to toe slope) is less than 45 degrees. In addition, the operator will maintain an adequate factor of safety as determined by a licensed geotechnical engineer. A study and corresponding geotechnical report assessing highwall stability and making recommendations on exposed highwall angle and height will be submitted to DOGM by August 31, 2015. Highwall and slope stability will be monitored on an ongoing basis and stability will be re-evaluated if either the geomechanical properties of the rock or the phreatic surfaces change. Final highwall exposure will not exceed 50 feet in height or be steeper than 65 degrees, until such time as a licensed geotechnical report has been completed. Simplot will leave the highwall in a natural looking roughened state which minimizes hazards. A berm is constructed along the top of the highwall for safety purposes.

Photograph examples of highwalls created on the western portion of the mine site are presented in **Figure 14**. Simplot has gained 55 years experience in reclamation on reclaiming, grading, and re-seeding variable angled slopes and highwalls to help reduce erosion problems. As described above, the entire highwall is not backfilled; however, portions of the highwalls are left exposed to blend into the existing landscape and create micro-environments to diversify biology. As illustrated in **Figure 15** and 55 years of mining experience at the site, the remaining exposed highwall is stable.

Wildlife passage corridors are established where practical in the reclamation areas (north/south corridor).

Where drainages cross the highwalls, they are stair-stepped across the upper and lower cliff former - down the overburden, in the final cut. These cliff formers are an erosion resistant limestone as is evident by their natural vertical stance in the area. The drainage channel is filled with large boulders and riprap and the final cut is riprapped where water flows into the cut. The final cut drains toward established drainages. The final cut adds topographic diversity to the area, which is beneficial to wildlife. The highwall is staggered so as not to expose a single unbroken line to view. The highwall blends in with other landscape features in the area.

#### IMPOUNDMENTS, PITS, AND PONDS

The permitted TSF facility has sufficient capacity to store tailings generated as part of the proposed 10-year mine plan presented in this NOI. Therefore, Simplot is not seeking any changes to the current operations of the TSF facility. Reclamation of the TSF facility will be in accordance with *Notice of Intention to Revise Large Mining Operations Tailings Storage Facility the August 11, 2015 Tailings Storage Facility Amendment*, which is included in Appendix L dated March 20, 2000. It is anticipated that the seed mix in the March 20, 2000 document will be updated to reflect DOGM recommended seed mix, but the overall approach described in the document remains valid. Appendix L includes a copy of the *Notice of Intention to Revise Large Mining Operations Tailings Storage Facility* document. Concurrent reclamation of the TSF is primarily limited to the downhill slopes during operations, as reclamation of the pond area is not practical since it is constantly being

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filled. The TSF will be reclaimed upon closure of mine operations in accordance with a mitigation plan (see *Tailings Storage Facility Amendment dated August 11, 2015 and included in Appendix L*). Simplot has been conducting tests to determine direct re-vegetation options for the tailings material.

The permitted on-site solid waste landfill will be reclaimed in accordance with permit R315-305(5). The landfill is bonded through Utah Department of Environmental Quality.

#### DRAINAGE

Although drainages are re-established in areas similar to pre-mining locations, actual elevations of the stream channels may vary. This is because re-grading causes the sides of stream channels to be less steep and the floor of the channel less deep than pre-mining conditions. This results in more of an undulating topography than what may have existed prior to disturbance. See discussion in section below on stormwater management and drainage.

#### EROSION, SEDIMENT, AND RUNOFF CONTROL

As described above, Simplot mining operations are conducted under Utah's *Multi-sector General Permit for Stormwater Discharges associated with Industrial Activities* (UTR000000) (see copy in Appendix F-5). Furthermore, the mine site is classified under Group 5, Sector J – Mineral Mining and Processing Facilities. To support the permit for stormwater discharges, Simplot has developed a SWPPP, which addresses the management of stormwater, through implementation of BMPs, to ensure that stormwater discharges to surface water meets water quality criteria. The SWPPP addresses drainages and the implementation of structural and non-structural features that control pollutants in stormwater runoff. As part of the expansion project, Simplot will update the SWPPP, including drainage maps and implementation of control structures, to ensure that permit conditions are met. Simplot includes stormwater management (drainage) of reclaimed facilities in its SWPPP until the reclaimed facility (bonded area) is formally released by DOGM. Once released, the area is no longer part of the stormwater management area.

The following paragraphs describe BMPs for runoff and erosion control associated with post-mining (reclaimed areas):

- The mine expansion areas does not disturb perennial streams. Surface water drainages in disturbed areas requiring reclamation would be associated with stormwater runoff associated with rainfall and snow melt. Surface water control is an integral part of the mine reclamation. The main objectives of control at the facility are 1) to prevent runoff from disturbed areas reaching water courses downstream until settlement of the sediments has been accomplished; and 2) to prevent the loss of valuable topsoil and nutrients by erosion during and after reclamation. Should runoff come in contact with downstream water systems the most serious consequence would be the addition of sediments, thus raising the total dissolved and suspended solids.
- Runoff control in the reclaimed mine areas, and reclaimed roads, are achieved by one or more of the following three methods: (1) contour and seeding furrows; (2) permanent settlement basins; and/or (3) percolation basins. Runoff control of any access roads that are kept open after reclamation is achieved by 1) diverting runoff to temporary settling and evaporation basins; and 2) routing runoff along berms or ditches to percolation basins.
- Grading of spoil ridges commence as soon as possible under safe operating conditions. Erosion control, moisture conservation, and aesthetic qualities are the considerations guiding re-contouring and grading of the surface. Aesthetic qualities are the considerations guiding

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# Application for Mineral Mine Plan Revision or Amendment

**Operator:** Simplot Phosphates, LLC

**Mine Name:** Vernal Phosphate Operations

**File Number:** M/047/0007

Provide a detailed listing of all changes to the mining and reclamation plan that will be required as a result of this change. Individually list all maps and drawings that are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise or amend the existing Mining and Reclamation Plan. **Include page, section and drawing numbers as part of the description.**

## DETAILED SCHEDULE OF CHANGES TO THE MINING AND RECLAMATION PLAN

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 3.A and 3.B, Update life of mine estimate from 2000 to 2015, to 2043. Replace page 4 with Replacement pages 4 and 4a.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 3.B, delete reference to alternative site B. Delete last paragraph of Section 3.B, because it is no longer relevant. Replace page 4 with Replacement pages 4 and 4a.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 3.D, Update life of mine estimate from 2000 to 2015, to 2043. Replace page 6.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 5.A, Update water quality discussion to include monitoring data collected since 2000. Replace page 26 with replacement pages 26 and 26a.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 6.0, Update discussion of tailings dam reseeding to reflect work performed since 2000. Replace page 27 with replacement page 27.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 6.C, Update status of revegetation test plots. Replace page 30 with replacement page 30.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 6.G.4, Update final reclamation seed mix. Replace page 35 with replacement pages 35 and 35a.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 6.G.4, Update nurse crop reclamation seed mix. Replace page 36 with replacement page 36.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Section 8.0. Replace surety estimate with updated 2015 estimate.
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	List of figures. Updated to include new Figure 6.
<input checked="" type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	New Figure 6, showing location and treatments for test plots.

**I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments and obligations, herein.**

*Mark A. Krall*

Print Name

*Mark A. Krall*

Sign Name, Position

*10/8/15*

Date

**Return to:** State of Utah  
Department of Natural Resources  
Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
Box 145801  
Salt Lake City, Utah 84114-5801  
Phone: (801) 538-5291  
Fax: (801) 359-3940

**FOR DOGM USE ONLY:**  
File #: M/047/0007

Approved: \_\_\_\_\_  
Bond Adjustment: from \$ \_\_\_\_\_  
to \$ \_\_\_\_\_



## LIST OF FIGURES

Figure 1	Location Map
Figure 2	Tailings Storage Facility Map
Figure 3	Geology Map
Figure 4	Tailings Dam Cross Section
Figure 5	Vegetation and Soil Test Sites
Figure 6	<u>Revegetation Test Plots</u>

## LIST OF APPENDICES

Appendix A	NRCS Soils Survey Map
Appendix B	Soil Profile Data
Appendix C	Plant Survey Data



### 3.0 PROJECT DESCRIPTION - TSF EXPANSION

#### 3.A. Introduction

The Simplot phosphate mine and beneficiation facilities were first developed in the 1960s by the San Francisco Chemical Company and were purchased by Chevron Resources Company in 1981. In 1992, the mine, pipeline, and fertilizer plant were purchased by SF Phosphates Limited Company, a joint venture between the J.R. Simplot Company and Farmland Industries, Inc. In 2003, J.R. Simplot Company purchased Farmland Industries' interest in the facilities and formed Simplot Phosphates LLC to control the mine, pipeline, and fertilizer plant. References in this NOI update to SF Phosphates should be understood to refer to Simplot Phosphates LLC.

SF Phosphates Limited Company (SF) operates a phosphate mining and milling operation north of Vernal, Utah. The mining and processing operation employs approximately 140 people and results in a concentrated phosphate rock slurry product. A 96-mile pipeline to a fertilizer processing plant located near Rock Springs, Wyoming transports phosphate slurry. Preparation of the phosphate ore at the mine site results in the production of tailings that are directed to a facility specifically designed for this purpose. The projected life of the mine is approximately 100 years. The currently permitted tails disposal capacity is around 6 years. The permitted capacity, based on the 2000 NOI, is 100 million cubic yards (135 million tons). The facility currently contains approximately 62 million tons (Mt). Assuming the current annual production of approximately 2.6 million dry tons per year, the current Life of Mine for the Tailing Disposal Facility (TSF) is approximately 28 years, or 2,043.

The ~~Tailings Storage Facility (TSF)~~ includes both the dam(s) and the impoundment of water and tailings. Two types of tailings slurry produced in the mill are transported separately to the TSF for disposal. Fine tailings slimes are discharged by gravity-flow pumping to the ~~northeast area of the~~ tailings impoundment. Coarser tailings from the flotation cells are typically pumped to the crest of the tailings dam, are cycloned there and discharged along the upstream face of the dam. The cyclone unit is periodically moved along the crest of the dam, such that the sand fraction of the cycloned tailings solids forms a 150 to 200-foot wide sand beach along the entire upstream face of the dam. The clay and silt slimes fraction flows to the western portions of the impoundment, where solids settle from the host water. Clarified tailings water is reclaimed from the west end of the impoundment at a barge-mounted reclaim pump to be recycled to the mill process. The supernatant pond covers much of the tailings surface. It is shallow over most of the tailings and attains its maximum depth in the western area of the impoundment near the reclaim barge. Water reclaimed from the TSF is reused in the grinding and concentration process. A small quantity of process water is also used for transporting the phosphate concentrate to Rock Springs in the slurry pipeline.

#### 3.B. Proposed Project

~~An~~In 2000, an expansion of the Tailings Storage Facility ~~is was~~ necessary because it ~~is was~~ estimated that the current facility ~~will would~~ be filled to maximum capacity by the year 2006. The Raise 2 embankment elevation was 5,985 ft amsl, with Raise 3 currently being constructed to raise the embankment to 5,600 ft amsl. Raise 3 will provide storage for approximately 15 Mt of tailings, which provides 6 years of additional storage capacity (to approximately 2021), at the current production rate of 2.6 Mt per year. Since the anticipated life of the mining operation extends well beyond this, additional tailings storage capacity ~~must be developed has~~



~~been designed and permitted.~~ Expansion will occur as ~~seven~~four additional 15 ft ~~lifts~~raises spread over the next 25 years. Continued construction on the existing dam will allow phosphate production to continue with minimal impact to the environment. At the currently planned production rates, the proposed raise design would provide enough tailings capacity for about 28 more years of operation. ~~Tailings storage at the "B" site or An other remote areas may be needed in the distant future.~~

~~This Notice of Intent to Revise Mining Operations is submitted as required under the Utah Minerals Reclamation Program, Rules R647-1 through R647-5. Continued use of the existing TSF in expanded form will eventually result in disturbance of approximately 226 acres additional to the 365 acres associated with the current dam design and permit. A revision (as opposed to an amendment) of the existing Mine and Reclamation Plan is~~



Seepage control in the proposed raise would be provided by the 150- to 200-foot wide cycloned sand beach deposited along the upstream face of the dam. This permeable sand zone would direct seepage downward to the internal drain system of the existing dam. This drain system would continue to function as in the past, directing the seepage to the three collector drains in the same three locations as the current operations.

At the currently planned production rates, the proposed raise design would provide enough tailings capacity to accommodate about ~~4028~~ years of operation.

### 3.E. Inundation Area

The proposed expansion of the TSF will encompass approximately 226 acres in addition to the 365 total disturbed; 202.2 acres on SF Phosphates' property and 23.8 acres on Mill Sites filed on public land. This is in addition to the 365 acres disturbance under the existing plan. The 50-acre total is the maximum acreage that would be covered with tails or water during the operating life of the facility. As shown on Figure 2, the proposed final inundation level is expected to reach just over the 6050 ft elevation. Water will first begin to encroach upon the public lands in approximately 20~~20~~9 as tails fill the lower elevations of the impoundment. For final reclamation, grading and redistribution of the tailings will ~~be done~~occur. The highest elevation of tailings will be at the dam (eastern side) at approximately 6057 ft. The spillway discharge channel on the north side will be at an elevation of about 6053 ft. A pool of runoff water could form in the center of the impoundment on SF Phosphates' property. Water is not expected to accumulate on the public lands to the south. The final disposition of the surface of BLM lands will be dry tails reclaimed as described in Section 6.0. The final tailings surface on the southern edge of the impoundment will be about 120 feet greater than the existing tailings surface and at least 100 feet lower in elevation than the ridgeline of Red Mountain to the south.

### 3.F. Other Regulatory Permit Activities

The Bureau of Land Management (BLM) has published an Environmental Assessment (EA No. UT-080-1999-14) in regards to the Tailings Storage Facility Expansion. BLM review was required because 23.8 acres of public land will be eventually inundated by the pond and the dam will eventually cover 0.05 acres of public land. The public land involved is part of the Red Mountain - Dry Fork Area of Critical Environmental Concern (ACEC). This designation mandates EA level scrutiny for all proposed projects. A Record of Decision and Finding of No Significant Impact for TSF expansion was published on July 29, 1999 by David E. Howell, BLM Field Manager.

A Ground Water Discharge Permit was issued March 2000 by the Utah Division of Water Quality.

The Division of Water Rights - Dam Safety has reviewed ~~the~~and approved the permit level engineering specifications and drawings associated with this project. ~~Responses to that agency's comments are also currently being prepared.~~



## 5.0 IMPACT ASSESSMENT

### 5.A. Impacts to Surface and Groundwater Systems

A Ground water discharge permit ~~was~~, issued March 2000, is updated every 5 years, and is anticipated to be updated again in 2015, by the Utah Division of Water Quality. This permit requires practices and monitoring to reduce impact of the TSF on other surface and ground water sources.

Water quality monitoring focuses on the alluvial aquifer at the base of the embankment, the Moenkopi formation, and the conglomeritic Gartra Grit Member of the Chinle Formation. As required by the Groundwater Discharge Permit (UGW47001), water quality is monitored in a series of wells upgradient (4 wells) and downgradient (10 wells) of the TSF. Due to historic activity and possible contribution from the Moenkopi Formation (which has naturally elevated TDS and uranium) downgradient background water quality cannot be directly determined. Therefore, in the 2010 permit renewal, background groundwater quality and protection levels were calculated based on monitoring data for the period from 2000 to 2009.

Groundwater has periodically exceeded the groundwater protection levels for uranium and total dissolved solids (TDS), which is not surprising given that these constituents are elevated in the background water quality monitoring from the Moenkopi formation.

Evaluation of whether elevated TDS represents leakage from the tailings impoundment is complicated by the fact that tailings reservoir water has very similar chemistry to ground water that has been in contact with the Moenkopi Formation. As a compliance schedule item, Simplot Phosphates was required to investigate whether it was possible to distinguish tailings impoundment water from other natural waters at the site by its chemistry, and whether the observed changes in groundwater chemistry at well GE-2 represent leakage from the tailings impoundment.

In 2011, Simplot completed a "Source and Contamination Assessment" study at well GE-2. As required by the permit, the study evaluated water quality samples collected during 2010 to 2012, to assess the possibility that elevated TDS concentrations observed in samples of groundwater from GE-2 are the result of the influence of seepage from the tailings storage facility to alluvial ground water. Using hydrogen and oxygen isotope ratios, the study determined that the samples from GE-2 are similar to other groundwater samples and are likely not significantly influenced by seepage from the TSF (Formation Environmental 2015).

### 5.B. Impacts to Threatened or Endangered Species or Critical Habitats

Impacts to threatened/endangered species and critical habitats with respect to TSF expansion were addressed by BLM in the Environmental Assessment No. UT 080-1999-14. The EA determined that TSF expansion on the proposed 35-acre site posed no significant impact to threatened/endangered species or critical habitats. A Record of Decision and Finding of No Significant Impact for TSF expansion was published on July 29, 1999 by David E. Howell, BLM Field Manager.



### 5.C. Impacts on Existing Soil Resources

Under the current operation plan, approximately 16500 cubic yards salvageable topsoil would be inundated. This is in addition to 365-acre area already permitted. This is low quality soil, generally considered inferior to the tails material for which it will be substituted.

### 5.D. Impacts on Slope Stability, Erosion Control, Air Quality, and Public Safety and Health

The Division of Water Rights - Dam Safety ~~is also reviewing~~ has reviewed and approved the Issued for Construction (IFC) level engineering specifications and drawings for Raises 1, 2 and 3 associated with this project. ~~Preliminary response from the Dam Safety review is favorable.~~ Final plan approval and construction authorization ~~is eminent~~ for the initial raise was received June 20, 2000. Raise 3 (to 6,000 ft amsl) was approved by Dam Safety April 29, 2013.

The Division of Air Quality has issued a Title V Operating Permit that includes provisions for fugitive emissions associated with the dam and construction expansion.



## 6.0 RECLAMATION PRACTICES

The reclamation plan for the future closure of the TSF will incorporate direct seeding of the tailings solids. The proposed final revegetation program would include seeding grass directly on the tailings solids as soon as the water drains off and the area can be accessed for seeding.

The outer slopes of the tailings dam ~~will behave~~ **been** seeded as necessary during the life of the TSF to reduce erosion of the slope. It is expected that this slope will be adequately revegetated at the end of the TSF operations and will not need to be further reclaimed.

A tailings sampling program was conducted in 1997 and Golder Associates reviewed the potential for the dried tailings sand and slimes to support a perennial vegetative cover (Golder, 1998). Results for these samples were discussed in Section 3.

Direct seeding of the tailings solids is a ~~very~~ **very** viable approach to reclamation based upon pertinent characteristics. The tailings analyses indicated that the tailings pH is neutral. No soluble metals were identified at concentrations that would result in plant phytotoxicity. Soluble salts activity was at acceptable concentrations and acid-base accounting results indicated the tailings are strongly neutralizing and will not become acidic. There were deficiencies of available boron, zinc, nitrogen, potassium, and organic matter.

### 6.A. Statement of Reclamation Activities

SF Phosphates proposes to increase the authorized surface disturbances from 365 acres to approximately 591 acres. Most of this new disturbance will result from inundation of lands by impounded tailings.

It is the intention of SF Phosphates to reclaim this proposed expansion of the Tailings Storage Facility (TSF) to meet all federal and state requirements. Reclamation will be both concurrent, to the extent practical, and post use, following plans described herein. The reclamation approach and procedures outlined in this section were developed for the site-specific conditions of this area. The procedures are designed such that the disturbance areas are reclaimed to a productive use similar to the pre-mining land uses, and the reclaimed areas are visually and functionally compatible with the surrounding topography.

The conceptual reclamation plan described in this section has been prepared primarily by Golder Associates to provide the general framework for reclamation of the TSF. Given the long duration of this mining operation, SF Phosphates recognizes that the "state of the art" in reclamation may change significantly by the time the TSF is ready for reclamation. Also, changes in the beneficiation process and/or ore may result in a final tailings surface with different physical and chemical characteristics from those that currently exist. The methods and concepts presented in this section will likely be reevaluated and revised over the life of the project. Therefore, this plan will concentrate on identifying potential issues that may be encountered in reclaiming the tailings, and how these issues will be addressed.



Test plots ~~will also be~~ established in order to gain experience in direct revegetation of the tailings surface. Test plot establishment ~~will begin~~ in 2000, and ~~monitoring will likely occur throughout~~ 2002. Figure 6 presents the ~~life as-built~~ layout of the ~~facility~~-test plot, including the identified treatments applied to each subplot. ~~Monitoring data for the plots is currently unknown. However, independent visual observation in May 2015, indicates that all test plots are successful, with good diversity and some variability.~~ These plots are further described in Section 6.9H.

#### 6.D. Post-Mining Land Use

The proposed post-mining land use for the TSF expansion will be wildlife grazing and watershed protection.

#### 6.E. Post-Mining Topography

During the final years of operation of the TSF, the tailings discharge points will be adjusted as necessary to produce a final grade on the tailings solids toward the north end of the tailings dam where a spillway channel will be excavated. A spigot system is envisioned which can be moved around the east, north, and west edges of the pond. Spigots can also be migrated upstream as necessary to accomplish near final grade. Bulldozers may also be used to create relief and to achieve final grade and drainage. The channel has been designed to comply with Utah State Engineer requirements and to drain the peak flow from the PMP falling in the watershed above the tailings dam. This channel will prevent any significant accumulation of meteoric water against the tailings embankment.

The outer slope of the tailings dam will be constructed at a 2.5h: 1v overall slope and has been shown to be stable under static and dynamic conditions (Knight Piésold, 1997, Golder, 1998). Therefore, the outer slope of the tailings dam will not be regraded at the end of operations of the TSF. The revegetated face of the embankment will minimize erosion. By the end of operations, the upstream slope of the dam will almost be covered with a beach of tailings sand so the upstream slope of the dam will also not require regrading.

Reclamation of the proposed TSF will result in an area with less relief than the pre-mining topography for the area where tailings are deposited. The average grade of the reclaimed tailings surface will be about 2%. The reduced relief will result in several benefits to the area including less erosion and greater water retention, resulting in improved vegetation for use by wildlife.

#### 6.F. Potential Reclamation Issues

Several factors that are often the major concerns during reclamation of metal mines are not anticipated to be a problem for the SF Phosphates tailings. These include pH, which is neutral; metals, none of which were at phytotoxic levels; salts, which occur at acceptable levels; and, acid generation, which is not predicted to occur based on the strong acid neutralizing characteristics of the tailings. Many of the remaining issues are representative of the background conditions in the area and are not specifically related to the tailings. The factors that may complicate revegetation of the tailings are:

- N.P.K. and O.M. deficiency
- Potential salt accumulation over time (upward migration of soluble salts)



precipitation of 13 inches or less, corresponding to long-term, post-closure conditions. The extent to which seeding with final crop species is required will depend on the degree of natural ~~seu~~succession that occurs on the tailings during the drying and consolidation period. Unless acceptable vegetation species adapted to the anticipated long-term conditions become established relatively quickly through natural succession, seeding with the final slimes species mix will need to be performed to ensure permanent vegetation survival. ~~Presently, the final crop~~The original seed mix has been revised based on the results of reclamation efforts performed on the mine between 2000 and 2014 and recommendations from DOGM. Presently, the final seed mix composition and application rates planned for use in TSF reclamation are as follows:

<u>Common Name</u>	<u>Rate lbs/ac (PLS)<sup>2</sup></u>
<u>Western wheatgrass</u>	<u>1.00</u>
<u>Bluebunch wheatgrass</u>	<u>2.00</u>
'Hycres' crested wheatgrass	<del>0.25</del> <u>50</u>
Intermediate wheatgrass	<del>0.5</del> <u>1.00</u>
<u>Paiute Orchard grass</u>	<del>0.25</del> <u>50</u>
Basin wildrye	<del>0.75</del> <u>1.00</u>
Indian ricegrass	0.75
Lada <u>ek</u> alfalfa	0.50
Yellow sweetclover	<del>0.25</del> <u>0.50</u>
Palmer penstemon	<del>0.25</del> <u>50</u>
Small burnet	<del>0.75</del> <u>1.00</u>
<u>Mountain big sagebrush</u>	<u>0.05</u>
<u>Fourwing saltbush</u>	<u>2.00</u>
<u>Lewis flax</u>	<u>1.00</u>
<u>Western yarrow<sup>1</sup></u>	<u>0.10</u>
Wyoming big sagebrush <sup>1</sup>	<del>0.05</del> <u>25</u>
<u>4-Wing saltbrush</u>	<u>0.5</u>
<u>Whitestem Rubber rabbitbrush<sup>1</sup></u>	<u>0.425</u>
Forage kochia <sup>1</sup>	<del>0.25</del> <u>50</u>
<u>Bitterbrush</u>	<u>0.5</u>
<b>Total</b>	<b><del>5.70</del> lbs/ac<b>13.35</b></b>
<b>Cost/ac</b>	<b><del>\$46.57</del>/ac</b>

<sup>1</sup> Seeds need to be broadcast

<sup>2</sup> PLS = pure live seed

The nurse crop species were selected based on their tolerance to silt and clay textures and average annual precipitation of 15 inches or greater, corresponding to the period immediately following the end of tailings deposition when the tailings will still be wet. The nurse crop will be seeded progressively, probably by hydraulic seeding, as the tails waters recede. Its purpose is to provide immediate stabilization of the tailings surface, and to promote natural succession by increasing evapotranspiration and imparting shade and organic matter to the tailings. It will also protect the surface from wind and water erosion and provide protected micro sites for more desirable species to establish. The nurse crop seed mix will consist of a mixture of species that will establish in the current mesic moisture regime, but will not persist as the tailings dry to a more xeric condition typical of the surrounding area. The proposed nurse crop composition and application rates planned for use in TSF reclamation are as follows:



<u>Common Name</u>	<u>Rate lbs/ac €(PLS)</u>
'Hycrest' crested wheatgrass	0. <del>33</del> <sup>50</sup>
Orchardgrass	0. <del>33</del> <sup>50</sup>
Intermediate wheatgrass	<u>1</u> . <del>0</del> <sup>67</sup>
Basin wildrye	1. <del>05</del>
Ladalek alfalfa	<u>1</u> . <del>0</del> <sup>67</sup>
Yellow sweetclover	0. <del>33</del> <sup>5</sup>
Total	<del>3.35</del> <sup>0</sup> lbs/ac
<del>Cost/ae</del>	<del>\$11.36/ae</del>

These two seed mixtures and associated application rates are only tentative. The actual seed mixes and application rates used in TSF reclamation may change based on information obtained from the test plots results.

#### 6.G.5. Potential Amendments

When the tailings have dried (approximately 1 to 2 years to dry) to the point where they can support heavy equipment, the nurse crop will be tilled in and tailings surface can be graded and contoured. The tailings will then be seeded with a seed mixture consisting of species selected from the test plots. Fertilizer and other amendment rates will be determined based on the nutrient status of the tailings at the time of seeding and test plot results. Since the tailings will be deposited in a westerly direction, tails will dry first in the eastern end and reclamation could begin there first.

Based on the current nutrient status of the tailings, the following fertilizer and amendments would be required to sustain a permanent vegetation cover:

60 pounds P205/acre  
40 pounds K20/acre  
40 pounds N/acre  
10 tons O.M./acre

These recommendations are based on the tailings laboratory data discussed earlier. Specific amendment recommendations will be developed prior to reclamation and be based on results of test plots and nutrient analysis performed immediately prior to reclamation. These amendments would likely be applied along with the nurse crop during the hydromulching process. The O.M. recommendation is based on the assumption that the current O.M. content is negligible. Although the laboratory results indicate about 1 percent O.M., iron is known to interfere with the laboratory analysis resulting in positive errors (Lee 1939). The laboratory results indicate



## 8.0 SURETY

This section contains an itemized estimate of the costs involved in TSF reclamation. Cost estimates are based on ~~quotes received~~productivities estimated using DOGM productivity spreadsheets, publicly available unit rates (e.g., RS Means and SRCE), and material cost estimates from local contractors. Copies of these quotes aresuppliers. The estimated cost is ~~\$924~~8,494. This cost is included in ~~this section~~the site-wide updated surety cost estimate, which is provided separately.



Tailings Pond Impoundment									
Misc. roads and structures addressed elsewhere									
	Hourly Equipment Cost	Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Total Eq. & Lab. Costs	Units	Quantity	Production Rate <sup>3</sup>
Contouring D9 Dozer <sup>1</sup>	\$118.45	\$135.65	See note 12	74.15	\$254.10	\$2,032.82	\$/day	425.00	acres
Labor <sup>2</sup>					\$593.20	\$/day		425.00	acres
Subtotal									
Supervision/Administration (+10%)		\$116.72	\$68,980.93						
Subtotal		\$1,283.91	\$758,790.22						
Contingency (+10%)		\$128.39	\$75,879.02						
Total reclamation cost		\$1,412.30	\$834,669.24						
<sup>1</sup> Contouring D9 Dozer, includes equipment rental and operating costs (based on RS Means 2014 Item 01 54 33 4360 – 410 HP dozer ). Profit and Overhead included.									
<sup>2</sup> Labor (see Equipment and Operator Costs worksheet, based on RS Means 2014, Crew B10)									
<sup>3</sup> Production rate based on LCY; see productivity spreadsheet for calculation; based on CAT Production Handbook									

Ref	Description	Materials	Means Reference Number	Unit Cost	Unit	Area acres	Number <sup>5</sup>	Unit	Quantity	Unit	Cost
-	Application of drill seed	D4K XL Dozer (105 HP) <sup>1</sup>	01 54 33 20 4150 <sup>1</sup>	\$592	day	425	22	acre/day	19.3	days	\$11,433
-	Crew for Dozer	Crew for application	Crew B-10 <sup>2</sup>	\$593	day	425	22	acre/day	19.3	days	\$11,460
-	Application of broadcast by hand	Crew for broadcast	Crew B10S <sup>2</sup>	\$226	day	425	10	acre/day	42.5	days	\$9,614
-	Seed mix - drill seed	12.25 lbs/acre	Footnote <sup>3,4</sup>	\$102	acre	425	-	-	425	acres	\$43,308
-	Seed mix - broadcast	1.1 lbs/acre	Footnote <sup>3,4</sup>	\$36	acre	425	-	-	425	acres	\$15,249
-	Reseeding - assume 5%	Standard Vegetation Costs	-	\$214	/Acre	21.25	-	-	21.25	acres	\$4,553
-	SubTotal										\$95,615
<sup>1</sup> RS Means 2014, assumes 105 HP dozer; 14.81 acres/day for seeding provided by Simplot											
<sup>2</sup> RS Means 2014, Crew B010											
<sup>3</sup> Assumes no fertilizer											
<sup>4</sup> Stevenson Intermountain Seed quote of October 2013											
<sup>5</sup> See Productivity spreadsheet for seeding rate determination											



Project: Simplot Vernal Mine  
 Date: 04/18/15  
 Prepared by: Murray/Spencer

Field Code Changed

WORKSHEET 5  
 PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Overburden grading - pushing and contouring overburden material to final grade prior to applying topsoil and re-vegetating. Typical push is 100 feet. On average there is about 4800 CY of material moved per acre in reclamation based on experience at this site. Simplot conduct concurrent reclamation with overburden being pushed into previously mined pit.

Characterization of Dozer Used (type, size, etc.):

CAT D9R/D9T, 405 hp with universal blade and ripper. Differential steering Universal blade, 15'3" wide. Unadjusted Production (LCY/hr) = 1300 (CAT Performance Handbook Edition 44, page 19-51). Based on average dozer push of 100 feet.

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):

Overburden contouring. Grade varies from -20 to +20%, with overburden push to pits mostly being downslope; assume overall grade factor of 1.0.  
 Operator: average 0.75; Material: Overburden (unconfined) 1.0; job efficiency 50 min/hr = 0.83; weight correction assume same density as soil (2300 lbs/LCY)  
 Assume 4800 CY/acre of overburden dozer work based on experience at site.

Productivity Calculations:

$$\text{Operator Adjustment Factor} = \frac{0.75}{\text{operator factor}} \times \frac{1.00}{\text{material factor}} \times \frac{0.83}{\text{efficiency factor}} \times \frac{1.00}{\text{grade factor}} \times \frac{1.00}{\text{weight correction factor}}$$

$$\times \frac{1.00}{\text{production method/blade factor}} \times \frac{1.00}{\text{visibility factor}} \times \frac{1.00}{\text{elevation factor}} = 0.62$$

$$\text{Net Hourly Production} = \frac{1300}{\text{normal hourly production}} \text{ LCY/hr} \times \frac{0.62}{\text{operating adjustment factor}} = 809 \text{ LCY/hr}$$

$$\text{Hours Required} = \frac{4840}{\text{volume to be moved}} \text{ LCY} \div \frac{809}{\text{net hourly production}} \text{ LCY/hr} = 6.0 \text{ hr(s) per acre}$$

acres/day= 1.3376033

Data Source(s): Caterpillar Performance Handbook, Edition 44 Bulldozers



Project: Simplot Vernal Mine  
 Date: 04/17/15  
 Prepared by: Murray/Spencer

WORKSHEET 6  
 PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE - Seeding

Earthmoving Activity:

Cat dozer used for seeding. Drill seeder with disc

Characterization of Dozer Used (type, size, etc.):

Dozer D4K Series (CAT Edition 44),

Description of Dozer Use (% grade, effective blade width, operating speed, etc.):

Seeder and disc at 12 feet wide; 0.5 feet overlap, so effective pass width 11.5 ft  
 Average speed for drill seeding 3 mph (Simplot)  
 Operator: average 0.75; Material: 1.0; job efficiency 50 min/hr = 0.83; weight correction assume same density as soil (2300 lbs/LCY)

Productivity Calculations:

Operator Adjustment Factor = 
$$\frac{0.75}{\text{operator factor}} \times \frac{1.00}{\text{material factor}} \times \frac{0.83}{\text{efficiency factor}} \times \frac{1.00}{\text{grade factor}} \times \frac{1.00}{\text{weight correction factor}}$$

$$\times \frac{1.00}{\text{production method/blade factor}} \times \frac{1.00}{\text{visibility factor}} \times \frac{1.00}{\text{elevation factor}} = 0.62$$

Hourly Production = 
$$\frac{3.0}{\text{average speed}} \text{ mi/hr} \times \frac{12.0}{\text{effective blade width}} \text{ ft} \times 5280 \text{ ft/mi} \times 1 \text{ ac}$$

$$= \frac{43560}{\text{ft}^2} = 4.4 \text{ ac/hr}$$

Net Hourly Production = 
$$4.4 \text{ ac/hr} \times \frac{0.62}{\text{operating adjustment factor}} = 2.72 \text{ ac/hr}$$

$$22 \text{ acres/day}$$

Hours Required = 
$$\frac{1}{\text{area to be graded}} \text{ ac} \div \frac{2.72}{\text{net hourly production}} \text{ ac/hr} = 0.4 \text{ hr(s)}$$

Data Source(s): CAT Performance Handbook 44

Field Code Changed



# EQUIPMENT AND OPERATOR COSTS

RS Means Heavy Construction Cost Data (2014, 28th annual addition)

Equipment rental costs based on Monthly rental rate; divide by 21 days to get daily rate

Equipment operating costs based on hourly cost X 8 for daily costs

Operators wages included as separate line item

## D9 Dozer:

## RS Means (2014) 01 54 33 4360 410 HP

<u>Rent per month:</u>	<u>\$19,900.00</u>	<u>mo</u>
		<u>Based on month rate and 21</u>
<u>Rent per day:</u>	<u>\$947.62</u>	<u>days</u>
<u>Hourly operating cost:</u>	<u>\$135.65</u>	<u>hr</u>
<u>Equipment Cost per day:</u>	<u>\$2,032.82</u>	<u>day</u>

## Crew

## RS Means 2014 B10B

<u>Equipment Operator O&amp;P</u>	<u>\$74.15</u>	<u>hr</u>
	<u>\$593.20</u>	<u>day</u>

## D4K XL Dozer:

## RS Means (2014) 01 54 33 20 4150 105HP

<u>Rent per month:</u>	<u>\$4,550.00</u>
<u>Rent pr week</u>	<u>\$1,515.00</u>
<u>Rent per day:</u>	<u>\$216.67</u>
<u>Hourly operating cost:</u>	<u>\$36.10</u>
<u>Equipment Cost per day:</u>	<u>\$591.80</u>

## Crew

## RS Means 2014 B10B

<u>Equipment Operator O&amp;P</u>	<u>\$74.15</u>	<u>hr</u>
	<u>\$74.15</u>	<u>hr</u>
	<u>\$593.20</u>	<u>day</u>

## Crew

## RS Means 2014 B10S

<u>Laborer for broadcast seeding</u>	<u>\$226.00</u>	<u>day</u>
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